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ABSTRACT

Two experiments involving 36 deaf students investigated the effect of interpreted versus printed presentation on the recall of thematically relevant material. In Experiment 1, 20 deaf college students received an interpreted, videotaped presentation of one lecture and a printed presentation of a second lecture, with the two lecture topics counterbalanced. Immediately after each lecture, students wrote down the important information they could remember. The recall protocols were scored for the rated importance level of the ideas they cortained. Students recalled more idea units rated as important when the lecture was printed than when it was interpreted. Furthermore, they recalled more units at all levels when the lecture was printed than when it was interpreted. In Experiment 2, 16 postsecondary level deaf students received one interpreted lecture and then a second interpreted lecture on a different topic. Students again recalled more units rated as important. In addition, recall of the second lecture was greater than that of the first. (Author/SBH)

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Recall of Thematically Relevant Material by Deaf Students as a Function of Interpreted Versus Printed Presentation

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Abstract

In Experiment 1, 20 deaf college students received an interpreted, videotaped presentation of one lecture and a printed presentation of a second lecture, with the two lecture topics counterbalanced. Immediately after each lecture, students wrote down the important information they could remember. The recall protocols were scored for the rated importance level of the ideas they contained. Students recalled more idea units rated as important than as unimportant. Furthermore, they recalled more units at all levels when the lecture was printed than when it was interpreted. In Experiment 2, 16 deaf students received one interpreted lecture and, then, a second interpreted lecture on a different topic. Students again recalled more units rated as important. In addition recall of the second lecture was greater than that of the first.

Recall of Thematically Relevant Material by Deaf Students as a Function of Interpreted Versus Printed Presentation

Deaf students in post-secondary education programs, such as the National Technical Institute for the Deaf (NTID), are frequently mainstreamed into regular classess. In order to benefit from this instruction, it is essential for the deaf student to be able to comprehend and remember the material from the classroom lectures. At NTID interpreters are used extensively to help the deaf students better follow the classroom lectures. While an interpreter is clearly helpful, there is evidence, however, that even with an interpreter, the deaf student does not comprehend as much information as does his normal-hearing peer. Jacobs (1977) found that normal-hearing students performed better than deaf college students on a comprehension test after an interpreted lecture. In order to deal with the comprehension difficulties of deaf students, an important step would be to identify the processing strategies necessary for effective comprehension and retention of lecture information.

Previous research on the comprehension and retention of interpreted prose have tested for recall of certain specific facts (e.g. Gates, 1971; Panko, 1975; Caccamise, Blasdell and Meath-Lang, 1977). These studies have not dealt with the strategies deaf students use to select and retain particular ideas from a large body of information, such as a lecture.

The present study examines one comprehension-retention process: Recall of thematically relevant units or propositions. Thematic relevance refers here to the extent a proposition consitutes an essential piece of information.

Propositions Rated for Importance

One procedure for identifying thematically relevant units was developed by Johnson (1970) and Brown and Smiley (1977). In this approach judges rate propositions for importance using a scale of one to four. Brown and Smiley found that normal-hearing children and adults recalled most frequently the ideas that were rated as most important to the theme of a story; they recalled least frequently the ideas rated least important (Brown and Smiley, 1977; Smiley, Oakley, Worthen, Campione and Brown, 1977). The material they used for obtaining the ratings and the recall protocols were short Japanese folk tales.

In the present study the rating approach was applied to lecture material that was greater in length, and appropriate for the reading level of post-secondary deaf students. For these materials the levels of importance were distinguished and defined as follows:

1. Propositions at the level of most important generally contain a concrete piece of information, such as a specific event; in addition, these propositions relate information to a framework that summarizes the passage. For example, the following proposition was rated at the level of most important in a lecture on modern attitudes toward death: "She (Margaret Mead) said that the bomb and nuclear power have made us more aware of death."

2. Propositions at the second most important level contain concrete pieces of information, but these propositions do not relate the information to the summary framework. The following proposition was rated at this level: "That subject is death."

3. At the second least important level, the propositions contain either redundant or vague information. For example, the proposition, "The idea of death is not very pretty," was rated at this level. This proposition elaborated upon information in a previous proposition, but did not introduce new information.

4. At the least important level, information is either absent or irrelevant. Here is an example of a proposition at this level: "It is true."

Propositions Recalled Once vs. Those Recalled More than Once

The present study included a second approach for identifying thematically relevant units that was developed by Kintsch and Kozminsky (1977). In examining the way normal-hearing college students summarized information in a story, Kintsch and Kozminsky distinguished between propositions of two types: (a) Propositions that also appeared in at least one other student's protocol (common propositions); and (b) those that appeared only in one student's protocol (unique propositions). Kintsch and Kozminsky regarded the information in common propositions as more important than that in unique propositions, since the latter often seemed to contain irrelevant material. Obviously, their procedure did not differentiate between propositions in terms of relative importance to the same extent as did the Brown and Smiley (1977) procedure.

Interpreted vs. Printed Material: Processing Strategies

Some of the words in an interpreted lecture may be unintelligible to a deaf student, due to difficulties with lipreading, fingerspelling, etc. Consequently, the student may have difficulty discerning and remembering propositions with relatively important information. The student may devote considerable effort to deciphering unintelligible words. This demand on

the student's processing capacity may interfere with ability to discriminate among propositions in terms of their importance.

In the first of two experiments, recall of propositions after viewing a videotaped interpreted presentation was compared with recall after reading a similar, printed presentation. The focus of the research was not on evaluating the relative intelligibility of print and videotape. Previous research has shown that a printed presentation is generally more intelligible than a televised, interpreted one (e.g. Gates, 1971; review by Stuckless, 1978). The present study attempted to take advantage of this fact in order to deliberately create a discrepancy in the intelligibility of the presentations. Another reason for selecting videotape was simply that it is a convenient research medium.

The measure of recall as a function of thematic relevance seemed well suited for a study comparing comprehension of printed material to that of interpreted material. The ability to concentrate on main events to the exclusion of nonessential material seems to be important in all comprehension activities, whether in the context of reading or in that of following an interpreter (cf. Smiley et. al., 1977). In contrast, performance on standardized tests of reading, lipreading or simultaneous reception may not reflect the underlying processes common to the comprehension of interpreted and printed prose.

Experiment 1

The purpose of Experiment 1 was to compare deaf students' recall of thematically relevant lecture material when the presentation was printed and when it was interpreted. If students recall fewer important propositions

in either of the two presentations, it would suggest that identification and retention of important information is more difficult for that presentation.

Method

Subjects. The subjects were 19 deaf volunteers 18 to 25 years of age who attended NTID. Their average pure-tone threshold in the speech range for the better ear was 96 dB (range: 67-115 dB). Their mean grade-equivalent score on the California Reading Comprehension Test was 9.34 (range: 7.9-11.8), and their mean score on the NTID writing test was 8.67 (range: 6.89-10.00). (This test has a scale of 1 to 10, and the mean score for the group was at a level where most of the written message could be clearly understood).

Materials. There were two printed lectures: "Modern Attitudes Toward Death", and "Jaws and Other Sea Monster Stories". Table 1 contains the introductory paragraph from the lecture "Modern Attitudes Toward Death". The

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Insert Table One

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lectures were composed by an English instructor at NTID. They were approximately equal in length (about 1200 words), vocabulary level, number of details, interest and structural organization. The structural organization of the two lectures was similar in the following respects: (a) The first paragraph was concerned with the contemporary relevance of the theme; (b) the second paragraph provided the main theme of the lecture; (c) each lecture contained a similar number of paragraphs dealing with selections of literature that elaborated upon the theme; (d) the distribution of topic sentences (at the beginning or end of paragraphs) was similar.

Each of the lectures was also videotaped (in color) with an interpreter. The printed and video-taped versions of each lecture were identical, except for omission of some colloquialisms in the video-taped version. The format of the video-taped lectures consisted of an interpreter in the foreground and a lecturer in the upper right hand corner of the screen in a smaller frame. This arrangement was an attempt to simulate the typical classroom situation as it appears to the student who is using an interpreter. The lighting was directed so that the lips and oral cavity of the interpreter were well illuminated.

Procedure. The students were tested in groups of one to four. All students were administered one interpreted and one printed lecture, with topic ("Jaws" vs. "Death") and type of presentation (printed vs. video-taped) counterbalanced. While viewing the interpreted lecture, students sat approximately three feet from the screen. The interpreter signed at a rate of 112 words per minute in the "Jaws" lecture and at a rate of 106 words per minute in the "Death" lecture. The presentation times for the printed and interpreted lectures were approximately equal (9 and 10 minutes for the "Death" and "Jaws" lectures respectively).

The instructions preceeding the printed and interpreted lectures were identical except that for the printed lecture, the student was urged to study the material for the full time allotted. The instructions also included a list of the persons mentioned in the lecture and identified their roles. Finally the instructions informed the students that, immediately after the lecture, they would be asked to write down the important ideas and facts. Upon completion of the lecture, students received additional instructions:

(a) To write down the important ideas and facts; (b) to guess if uncertain about what they remembered; (c) not to include irrelevant material; (d) to limit recalls to one or two pages. The time limit for recall was twenty minutes.

Scoring of Recall Protocols for Rated Importance

Scoring the students' protocols for the importance of the propositions recalled required five steps:

1. Each of the two printed versions was broken down into propositions. A propositional unit was defined as a clause or sentence containing an action or stative verb. Relationships between modifiers and their modified terms were not considered separate propositions unless they appeared as relative clauses (Thorndyke, 1977). Furthermore, relative clauses merely introducing a statement were not counted. For each of the lectures, segmentation points for propositions were determined and compared for two coders. The percentage of agreement between the two coders was .81 for "Death", and .91 for "Jaws." Each disagreement between the coders on a segmentation point was resolved through discussion and they designated an agreed-upon segmentation.

2. Each lecture was broken down into propositional units which were numbered and typed consecutively, one per line. For each lecture, ten teachers from NTID's Communication Instruction department rated each proposition for thematic relevance on a scale of one to four. The teachers first read through the lecture, and then began the rating procedure by circling a one for the propositions which were least important. They then proceded sequentially through each of the other levels, finally circling a four for the most important propositions. They were asked to rate each proposition on its own merit.

From the teachers' ratings, a mean rating was computed for each proposition. On the basis of these mean scores, each proposition was assigned an importance level score of 1 to 4. Approximately one fourth of the propositions were assigned to each importance level. Table 2 shows the independent ratings of importance for the two lectures by the 10 teachers.

Insert Table Two

Intraclass correlation coefficients (Guilford, 1954, p. 395) were computed to obtain the extent of agreement among the 10 instructors in rating the importance level of each proposition. The correlation was .83 for the "Jaws" lecture and .84 for the "Death" lecture.

3. Propositional units were delineated in each of the student's written protocols according to the same procedure used for the lecture selections. Inter-coder reliability for the number of propositions in a recall was .95.

4. The students' recall protocols were scored for the number of propositions that matched those in the original lecture. A proposition in the student's protocol was scored as having matched a proposition in the original lecture if both contained the same main concept, irrespective of wording.

5. For each student, the number of matching propositions recalled at each importance level was tallied. In order to assess the reliability of these tallies for each importance level, a second individual independently coded 20 of the recalls, selected randomly. The four scores for each of the 20 protocols were correlated with the corresponding scores of the first coder. The reliability coefficients (r) for each importance level ranged from .87 to .92.

Common vs. Unique Propositions

Recall protocols were also scored for the number of propositions that appeared in more than one student's protocol (common propositions) and for the number that appeared only once in the protocols (unique propositions) as follows:

1. A list was made of all propositions used in the protocols for each lecture topic (i.e. "Jaws" and "Death"), and the number of students who recalled each of the propositions was tallied. Within each of these lists, propositions recalled when the lecture was interpreted and when it was printed when listed together.

2. Propositions were classified as common or unique. The number of propositions classified as common in the "Jaws" lecture was 37 and the number in the "Death" lecture was 34. The number of propositions classified as unique in "Jaws" was 36 and that number in "Death" was 29.

3. Each student received a score for the number of propositions they recalled that were common and for the number recalled that were unique. In order to assess reliability of the scoring, a second coder scored 20 of the recall protocols selected randomly. The results of each coder's scores were correlated. The coefficients were .96 for common and .85 for unique propositions.

Results

Propositions Rated for Importance. Proportions were computed in order to analyze the data pertaining to recall at the four levels of importance. Each of the four proportions was computed by dividing the number of propositions recalled at the level of importance by the total number of propositions

written in the protocol (Counting both propositions matching and not matching those in the original lecture). The rationale for this procedure was to control for length of the written protocol. The mean number of propositions written in response to receiving the printed and interpreted lectures were, respectively, 28.26 (SD = 10.33), and 27.32 (SD = 10.52).

The mean proportion of propositions recalled at each level of importance, as a function of interpreted versus printed lecture, is shown in Figure 1.

Insert Figure 1 about here

An analysis of variance comprised of two within-subject factors was performed on these data, yielding the following results: (a) Students recalled more propositions rated as important than as unimportant, $F(3,54) = 7.52$, $p < .001$; (b) Students recalled more propositions at all levels when the lecture was printed than when it was interpreted, $F(1,18) = 11.94$, $p < .03$. The interaction effect was not statistically significant. With respect to the effect of importance levels, the recall patterns were similar for the printed and interpreted lectures, as can be seen in Figure 1.

Additional analyses were conducted to check for possible differences in recall as a function of lecture topic (i.e. "Jaws" vs. "Death"). The effect of the lecture topic was not statistically significant. Furthermore, there was not a significant lecture-topic importance-level interaction.

Common and Unique Propositions. Proportions were also computed in order to analyze the data for recall of common and unique propositions. These proportions were the number of common propositions recalled, divided by the number of propositions written and the number of unique propositions recalled,

divided by the number written. Student recalled more common propositions when the lecture was printed (M = .29) than when it was interpreted (M = .45), $t(18) = 3.06$, $p < .01$. The mean proportion of unique propositions recalled for the interpreted and printed lectures were, respectively, .07 and .11 and the difference between these means was not statistically reliable, $t(18) = 1.68$.

Experiment 2

The purpose of Experiment 2 was two-fold: (a) To observe again for the interpreted, videotaped lecture the proportion of propositions recalled at different levels of importance; and (b) to compare recall of one interpreted lecture with that of a subsequent interpreted lecture on a different topic. The results of Experiment 1 indicated that for both the printed and interpreted lectures, students recalled more propositions rated as important than propositions rated as unimportant. Since Experiment 2 used only interpreted lectures, a replication of the recall pattern yielded by Experiment 1 would increase confidence in the conclusion that, for interpreted material, students recall the important information most frequently.

Experiment 2 also attempted to determine whether ability to comprehend and remember the important information would improve from the first to the second lecture. It is possible that the experience of recalling a lecture after the first presentation prepares the student to more effectively discern and remember the relatively important information in the second presentation (cf. Adjunct question literature; e.g. Faw and Waller, 1978). Furthermore, the student might have become familiarized with the interpreter's particular style of signing for the second presentation, thereby increasing its intelligi-

bility. Each of these factors could contribute to better recall on the second presentation. On the other hand, ability to recall information from a particular sample of prose material may depend partly upon the student's knowledge of the particular topic under discussion. In addition, recall may depend partly upon the student's general level of comprehension skills (Voss, 1974). If these factors are the primary determinants of recall, then performance should not improve from the first to the second presentation when the two lectures deal with different topics.

Method

Subjects. There were 16 NTID students who participated in Experiment 2. The group was similar to that in Experiment 1 with respect to the following characteristics: Puretone threshold for the better ear in the speech range (M = 89.9 dB, range = 67-120 dB); California Reading Comprehension scores (M grade equivalent = 9.19, range = 7.4-10.6); and NTID writing scores (M = 8.75; range = 6.5-10.0).

Materials and Procedure. The same videotaped, interpreted lectures that had been used in Experiment 1 were also used in Experiment 2. Students viewed one lecture and immediately thereafter wrote down the information they remembered. Subsequently, they viewed a second lecture and again performed the recall task. Eight of the subjects viewed Jaws as the first lecture and death as the second, and the other eight viewed the lectures in reverse order. The instructions preceeding the lectures and the recall tasks were identical to those used for the interpreted lecture in Experiment 1.

Scoring of Recall Protocols. Each student's protocol was scored for the number of propositions recalled at each level of rated importance as

described in Experiment 1. Note that the importance level for a proposition (on a one to four scale) was based upon the resultant mean score for that proposition in the original lecture, as derived from the ratings by the 10 communication department instructors.

In addition, each student's protocol was again scored for the number of common and unique propositions recalled. In order to obtain these scores for Experiment 2, however, new lists had to be made of all the propositions used in student protocols for each lecture topic. Within each of these lists, propositions recalled when the lecture served as the first presentation and those recalled when the lecture served as the second presentation were listed together. Propositions were once more classified as being either common or unique. For Experiment 2 the numbers of propositions classified as common were 36 in the "Jaws" lecture and 33 in the "Death" lecture; the numbers classified as unique were 40 and 35, respectively.

Results

Propositions Rated for Importance. In Experiment 2 the mean number of propositions written by students after viewing the first lecture was 26.12, and the mean for the second lecture was 28.19 (counting both propositions matching and not matching those in the original lecture). In analyzing the data, proportions were again computed to control for protocol length.

The data for rated importance level were analyzed (a) to determine the proportion of propositions recalled at each level of importance and (b) to compare recall for the first and second lecture. Figure 2 shows the mean proportion of propositions recalled at each level of importance for the first and second lectures.

Insert Figure 2 about here

These data were entered into an analysis of variance with two within-subject factors. As in Experiment 1, students recalled more propositions rated as important than as unimportant, $F(3,45) = 4.31$, $p < .01$. In addition, students recalled more information, at all importance levels, from the second lecture than from the first, $F(1,15) = 5.56$, $p < .03$. The interaction effect was not statistically significant.

Common and Unique Propositions. The data for Experiment 2 were also analyzed for recall of common and unique propositions. Students recalled more common propositions from the second lecture ($M = .43$) than from the first ($M = .31$), $t(16) = 2.75$, $p < .05$. The mean proportion of unique propositions recalled was .09 for both lectures, and, of course, there was not a statistically reliable difference between these means.

Discussion

The most important finding was that recall was a function of the relative importance of the proposition in the lecture. This recall pattern was obtained in Experiment 1 in which interpreted and printed lectures were used and also in Experiment 2 in which only interpreted lectures were used. These results suggest that for both interpreted and printed lectures, deaf students could discriminate among propositions in terms of their relative importance and remember the more important ones.

The similarity in the recall patterns for the printed and interpreted lectures suggests that students used essentially the same strategies for comprehending and remembering both forms of presentation. This conclusion

is consistent with those drawn by Smiley et. al. (1977) and Kintsch and Kozminsky (1978) who independently compared free recall of printed and spoken prose by normal-hearing persons. Both investigations found that recall patterns were similar for the two types of presentations. In these studies, however, the total amount of information that persons recalled (irrespective of importance) was similar for each presentation. In contrast, in the present study, students recalled less information overall when the lecture was interpreted. It is striking that, in spite of the reduction in recall, the deaf students were still able to differentiate among propositions in terms of their importance.

The finding that recall, overall, was greater when the lecture was printed is consistent with previous research comparing the effectiveness of printed and interpreted presentations (cf. Stuckless, 1978). The present study extends this line of work by comparing performance on a measure of free recall. The previous research had compared performance on multiple-choice tests.

At first glance, finding that subjects recalled fewer common propositions in the interpreted lecture than in the printed one seems contrary to the conclusion that students used similar strategies for comprehending and remembering the interpreted and printed lectures. Recall of common propositions can serve as a measure of retention of important information. With respect to the present study, however, recall of common propositions seemed to reflect overall retention of information rather than ability to discern the most important.

An interesting finding in Experiment 2 was that recall improved from the first to the second interpreted lecture. This improvement could be due

to either: (a) The students developing a preparatory set that may have increased the efficiency of the information processing in the second lecture; or (b) students being more familiar with the interpreter's particular style of signing. Future research might determine which of these factors is critical by presenting successive lectures with a different interpreter for each one.

The reader may wonder whether the deaf students had difficulty expressing themselves in writing. Perhaps the students might have recalled more information if they had responded in manual communication or if a multiple-choice test had been used? These are empirical questions we plan to investigate. In regard to the impact of writing ability in the present study, two steps were taken to minimize its significance. First, in both experiments, the design controlled for writing ability by subjecting each student to all treatment combinations; thus, differences in recall should have reflected treatment effects. Second, the subjects in the present study had good writing ability relative to most deaf persons. The reader should also note that previous research comparing the written and spoken recall of normal-hearing fifth graders found than even when writing ability was limited (as it presumably was for these children), recall was similar in each modality (Brown and Smiley, 1977). Thus, recall performance might also be similar in the signed and written modalities for deaf students.

In order for the deaf student to effectively process information from an interpreted lecture, he needs the ability to discern the most important ideas. A student retains only a limited amount of information from a lecture. It is critical that this information be the most important, since the student will rely upon it to understand subsequent information and to prepare himself

for tests. For these reasons, the processes of (a) differentiating among propositions, or ideas, in terms of relative importance, and (b) remembering these important ideas, are clearly of educational significance. If deaf students have difficulty discerning the important information, it is essential to find ways to help them overcome this problem.

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R(3/24/80):mni

Table 1

Example of Material Used in Interpreted and Printed Lectures: Introductory Paragraph from "Modern Attitudes Toward Death"

Recently, many people around NTID have been talking about a subject that was never discussed a few years ago. That subject is death. The idea of death is not very pretty, it is true. But people in the 1970's are becoming more and more open-minded about the topic. At NTID, many students are discussing the ideas related to death. There are many reasons for this interest. Some students have had parents or close friends die. Cancer and heart disease are big health problems in the United States, and we read about these problems in the newspaper every day.

Table 2

Independent Ratings of Importance for

the Two Lectures by Ten Instructors

Importance Level	Units (N)	Mean Rating	Rating Range
	"Jaws and Other Sea Monster Stories"		
1 (least)	36	1.50	1.0-2.0
2	31	2.25	2.1-2.4
3	29	2.75	2.5-3.0
4 (most)	36	3.50	3.1-3.9
	"Modern Attitudes toward Death"		
1 (least)	21	1.50	1.0-2.0
2	20	2.30	2.1-2.5
3	20	2.75	2.6-2.9
4 (most)	26	3.30	3.0-3.9

Figure Captions

Figure 1. Mean Proportion of Propositions Recalled at Four Levels of Importance when the Lecture was Printed and when It was Interpreted.

Figure 2. Mean Proportion of Propositions Recalled at Each Level of Importance as a Function of Position in the Two-lecture Sequence.

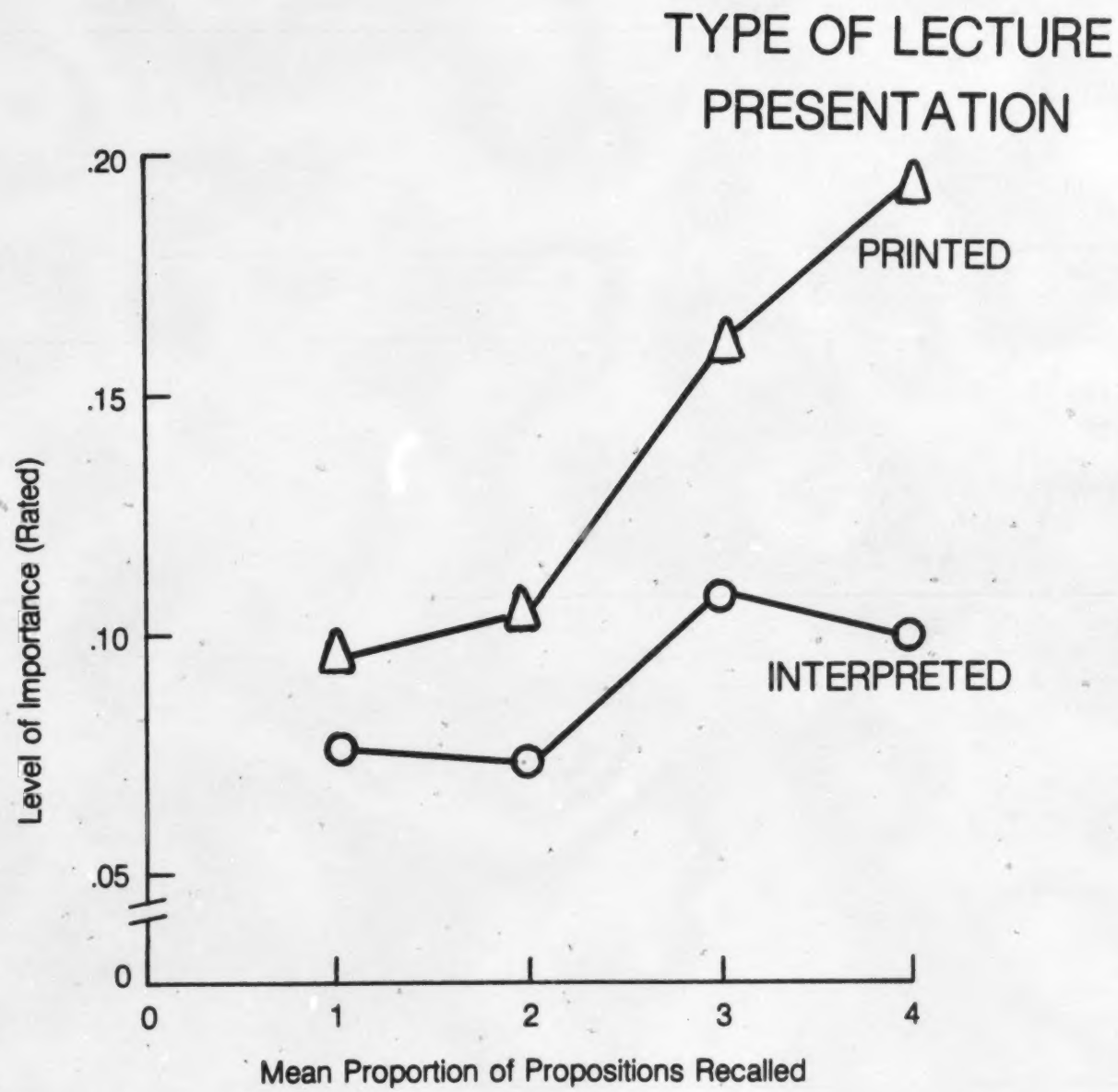
TYPE OF LECTURE PRESENTATION
PRINTED
INTERPRETED
Level of Importance (Rated)
.20
.15
.10
.05
0
0
1
2
3
4
Mean Proportion of Propositions Recalled

Figure 1

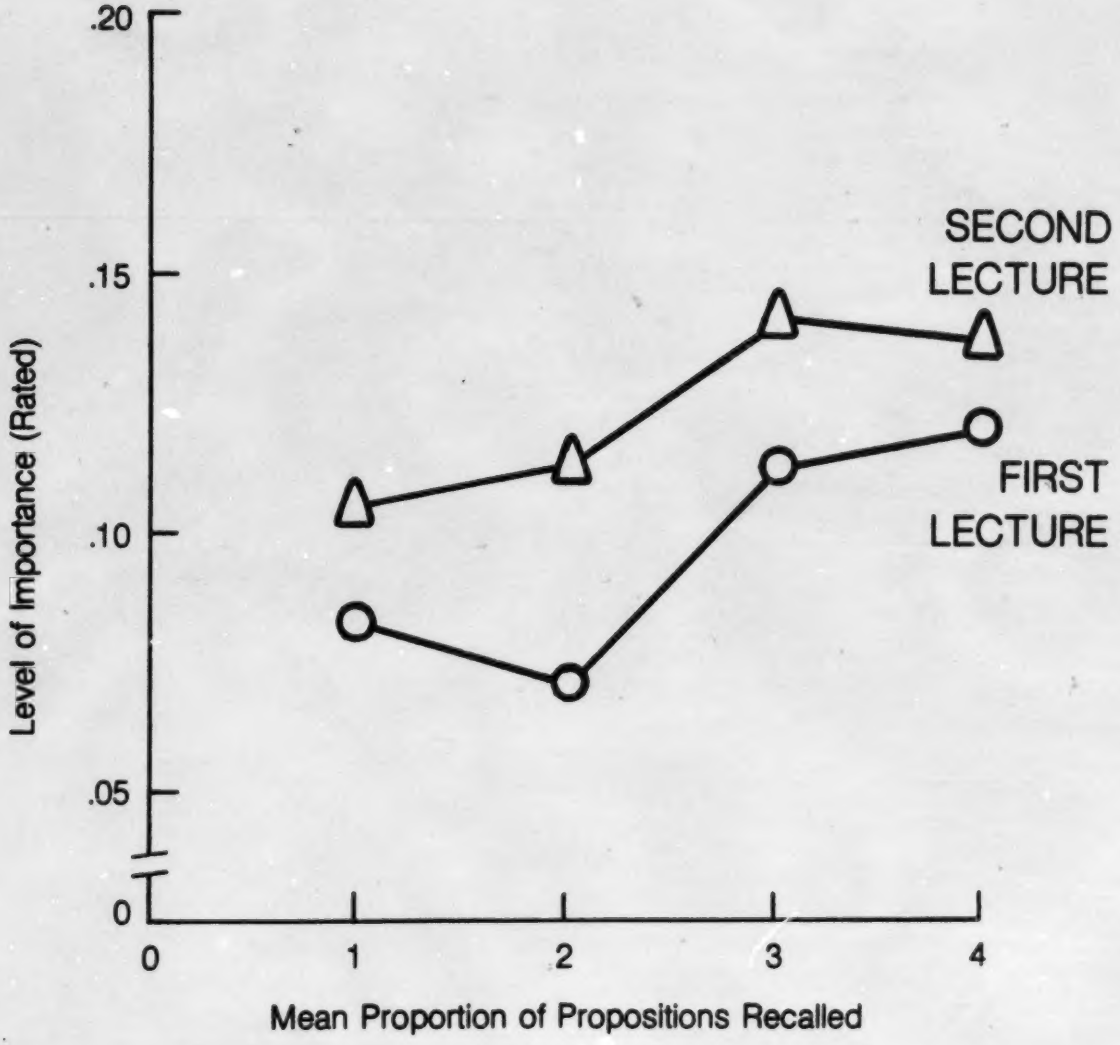
.20
.15
.10
.05
0
Level of Importance (Rated)
SECOND LECTURE
FIRST LECTURE
0
1
2
3
4
Mean Proportion of Propositions Recalled

Figure 2